Plant Archives Volume 20 No. 2, 2020 pp. 5627-5632 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

DETERMINE AND STUDY THE PROPORTIONS OF CLOUDY RAINY DAYS TO THE PROPORTIONS OF NON-RAINY CLOUDY DAYS OVER BAGHDAD CITY, IRAQ

Hasan M. Azeez

Department of Atmospheric Science, Collage of Science, Mustansiriyah University, Iraq.

Abstract

Clouds are one of the most important elements of the atmosphere, which is an indication of the amount of rain. So the idea of research came in determining the number of cloudy days to rainy days as a percentage through which it is possible to know the possibility of rain in the event that the weather is cloudy. To achieve this goal, data was used for both the amount of clouds and the amount of rain for the city of Baghdad by the General Authority for Meteorology and Seismic Monitoring as the appropriate period for this study is from (2010-2015) at the rate of eight observations per day and the data were of two types, daily and monthly. The analysis of the quantities of clouds produced and not produced for rain by comparison between months and the rainy season. Where it was found that the rainiest season during the study period was in the year 2013, when it reached 182.255 mm. The calculation of the monthly ratio between the number of rainy days to the number of cloudy days reached its highest value in the month of November, especially for the year 2013. The highest recurring value is for every two years. As for calculating the annual percentage for determining the rainiest days in number, it was for February with three years during the study period.

Key word: ratio, calculation, rainy, cloudy.

Introduction

Rain occurs due to the availability of a set of conditions. The most important of them is the presence of cloud cover, which is formed by the rise of moist air masses, weather disturbances and load currents. As well as the result due to fronts and depressions where many types of clouds are formed, but not all clouds are produced for rain, as in high and medium clouds.As the rains are closely related to weather factors because they have a clear importance such as humidity, condensation and condensation nuclei, as well as theories of rain formation such as cumulative theory and aggregation. And this correlation is found in some types of clouds, as in low clouds that are related to rain. There is a strong relationship with the amount of rain showers (Thoss *et al.,* 2001), the scientist (Zhang, 2015) studied the differences between clouds and precipitation and their relationship to aerosols, where the study was from 1990-2012. Where a decrease in total cloud cover and low clouds was observed by 0.85% 2.49% annually due to the depth of the aerosol (Zhang *et al.,* 2015). In (2010) satellites observations were studied by the scientist (Clin). Through the Moon (Cloudsat and Kalpsu) through the study of the vertical structure of clouds and precipitation, where the method of grouping is examined to sort the sub-patterns of clouds and frame by means of (CAM3) model where it was found that this model reduces horizontal clouds like low and medium at the difference of high clouds there is an escalation in the quantities of these clouds **(**Zhang *et al.,* 2010). (Mishra and Sharma, 2001), they searched about a study of estimating the intensity of rains using the temperature of the low tops of clouds. This research is based on showing the relationship between sub-zero temperatures and higher temperatures with the intensity of precipitation and the results showed that all clouds with cooler peaks of 275 K are the ones that contribute to rain (Mishra *et al.,* 2001). There is also a study in (2006) by the scientist (Kraider and Jungle) that shows the relationship between thunderstorms and rain for nine thunderstorms and monsoons on the east coast of Florida. Where it was found that rain tends to track thunderstorms. It was found that there was a delay of six thunderstorms by up to 20 minutes (Gungle *et al.,* 2006).

***Author for correspondence :** E-mail: hassan.m.a7878@uomustansiriyah.edu.iq

As for the scientist, he managed to compute a set of statistics for lost meteorological data for the past decades and compare them with the outputs of seven models of global climate models with a focus on cloud cover. Where they found that there is a difference between surface temperatures and atmospheric humidity as well as cloud cover and its association with long-term precipitation (Groisman *et al.,* 2000).

Cloud properties

The clouds characteristics are monitored, especially the product from them to the airport. When analyzing the data of each one, it was found that there is a difference in intensity and proportions depending on the type of cloud and the rainy season. It was found that there is a positive relationship with the intensity of precipitation with the months of the year, which varies from month to month and from year to year (Cattani *et al.,* 2009). However, precipitation depends on the growth processes inside the cloud for droplets that require a certain mechanical, provided that the basic elements of cloud formation are complete. As there is an effect on this growth is the amount of solution and the curvature of the droplet, so rainfall is a complicated process that can occur in the atmosphere and if not, it was dependent on the surrounding conditions inside and outside the cloud (Singh *et al.,* 2002). Clouds consist of tiny infinitesimal minutes. These droplets are of different shapes, some of which are spherical in most cases, but take different shapes depending on external influences. Clouds in their nature are formed in several ways these conditions are accompanied by conditions, which are the presence of sufficient humidity that reaches the level of saturation and low temperatures and condensation levels and once these clouds are formed, they will be formed in three levels (high, medium and shore) and each of these levels has a group of clouds. At the high level there are feathered clouds. These clouds do not have the ability to produce rain because of their high altitude, as they contain ice crystals because of the coldness of that level. As for the medium clouds, they are stratified and cumulative average, which is less high than the high clouds. The production of these clouds is little for rain, which may be non-existent, as they have developed and become one of the low clouds whose production is high as in the cumulative and muddy clouds (thunder clouds) with strong rain showers (Kokhanovsky, 2004).

Rain and its relationship to clouds

Rain is water falling to the ground by clouds. In which several complex physical processes occur which result in this type of precipitation, which consists of condensation of droplets inside the cloud by collision and cohesion between these droplets until they grow and are ready to fall. Rainfall varies from region to region. This difference is followed by several factors such as the type of clouds, water content and other climatic factors. Among the properties of (acidic) rains that directly affect the soil and plants and even in the water of rivers, they affect living organisms (Szyniszewska *et al.,* 2012).

Weather

Weather is an air between the air masses of different density. By knowing the air fronts that accompany the condition, depending on the temperature and humidity, with the difference in pressure in these blocks, there are two types of air fronts that accompany the clouds. The first type is the cold air front in which the cold air mass progresses over the warm air mass accompanied by cumulus clouds and thunderstorms accompanied by torrential rain, while the second type is the warm air front which is the opposite of the cold front where the warm air advances on the cold air, updating it. A change in the weather, forming stratified clouds, accompanied by showers at times, such as clouds formed in the month of April and May, *i.e.* the spring of the year (Roth, 2006).

The data used are by the Iraqi Meteorological Organization (IMOS), which monitors data for various weather elements, including the data used in the study. Where it is recorded in the weather conditions every three hours and then recorded as one number to represent the daily data for each of the two variables cloud cover and rain. The amount of cloud cover is determined by the sky observation methods, where the sky is divided into eight sections and on the basis of the presence of clouds, the amount of clouds is determined from eight and measured in unit (octas). The ratio of the number of rainy days to the number of cloudy days, called the Ratio, taking into account the neglected non-cloudy days, the data were dealt with by calculating the observations for one day and treating them as one value, whether for clouds or rain and determining the percentage for each month starting from October and ending with May and this is what is called the rainy season.

Materials and Methods

This research relied on two main factors: the number of clouds and the number of rainy days. Where (N) represents the number of days in which the weather is cloudy and (R) the number of rainy days over the city of Baghdad for the period (2010-2015) for the daily rates of hourly readings from the General Authority of Meteorology and Seismic Monitoring. Where the units of clouds are measured (at prices) and rain by (mm), where the time series of rainfall rates with clouds were

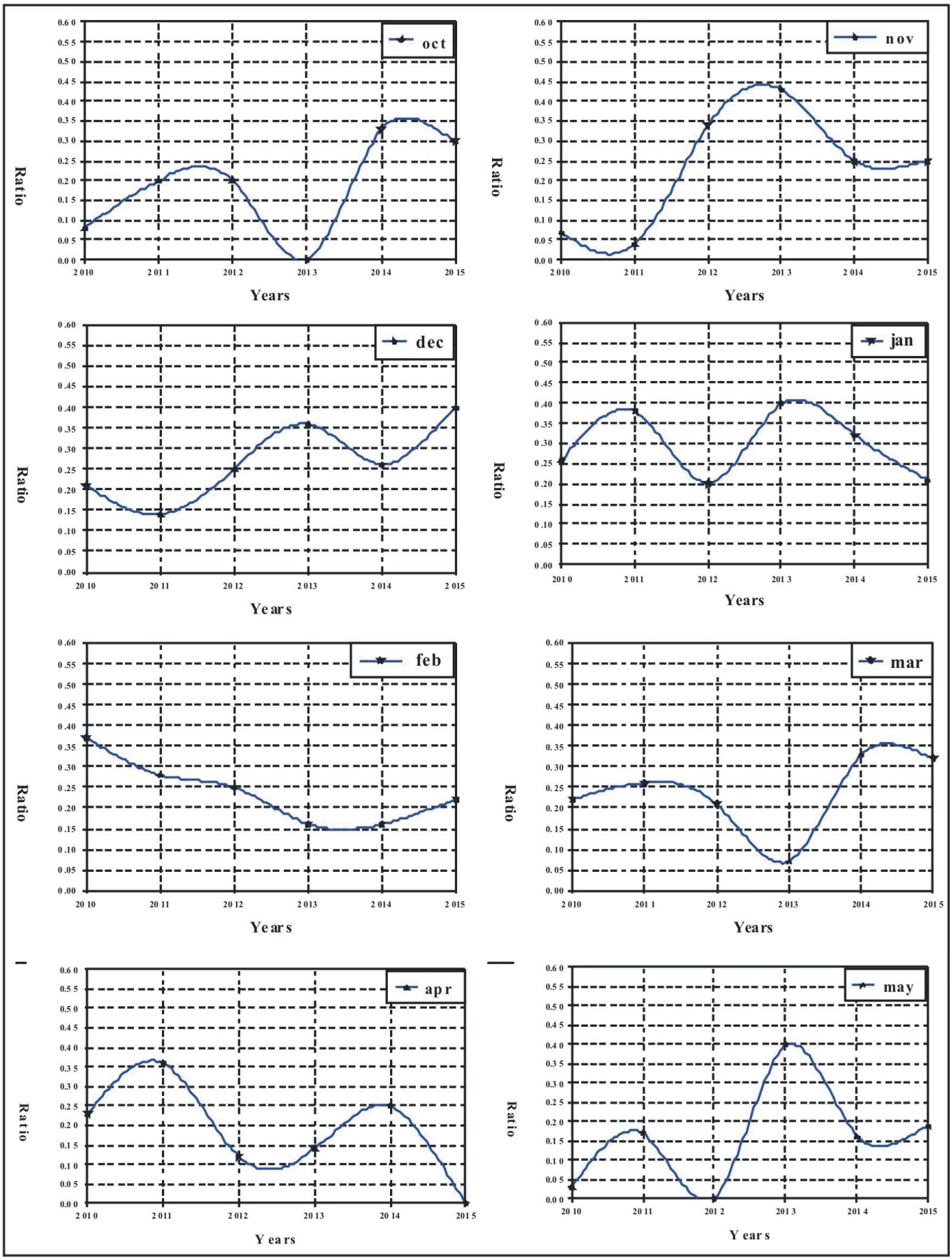

Fig. 1: Time series for rain full to clouds for the winter season a monthly for the period 2010- 2015.

studied. The rain-to-cloud ratios were compared through an equation (1) of monthly rates during the study period.

$$\text{Ratio} = \frac{\text{Rain}}{\text{Total cloud}} \quad \ldots 1$$

Results and Discussion

As it was found that the ratio of cloudy days to rainy days gives an inverse relationship, as in fig. 1. Since the basic principle is that not every cloudy day is rainy. Where it was observed through the results that we obtained during the study period. The rain rate for the percentage of clouds recorded its highest level in November of the year (2013), as it reached (0.42%) and the lowest rate was equal to zero. For example, in October (2013). The ratio between the amount of rain and monthly clouds is in the form of an oscillating wave between the highest value of (0.42%) and the minimum value of zero and it is noted that the period between the upper and lower value is two years except for the month of February, where the results showed that it is in a state of continuous decline that continues from the year (2010 to 2014) with a slight rise during the last year. Likewise, in the year (2015) for the month of December and its value (0.40%). Also in January and Jeddah, its value was (0.41%) in the year (2013) and in the same year, its rate for the month of May was (0.40%). Where it can be said that the highest cases of

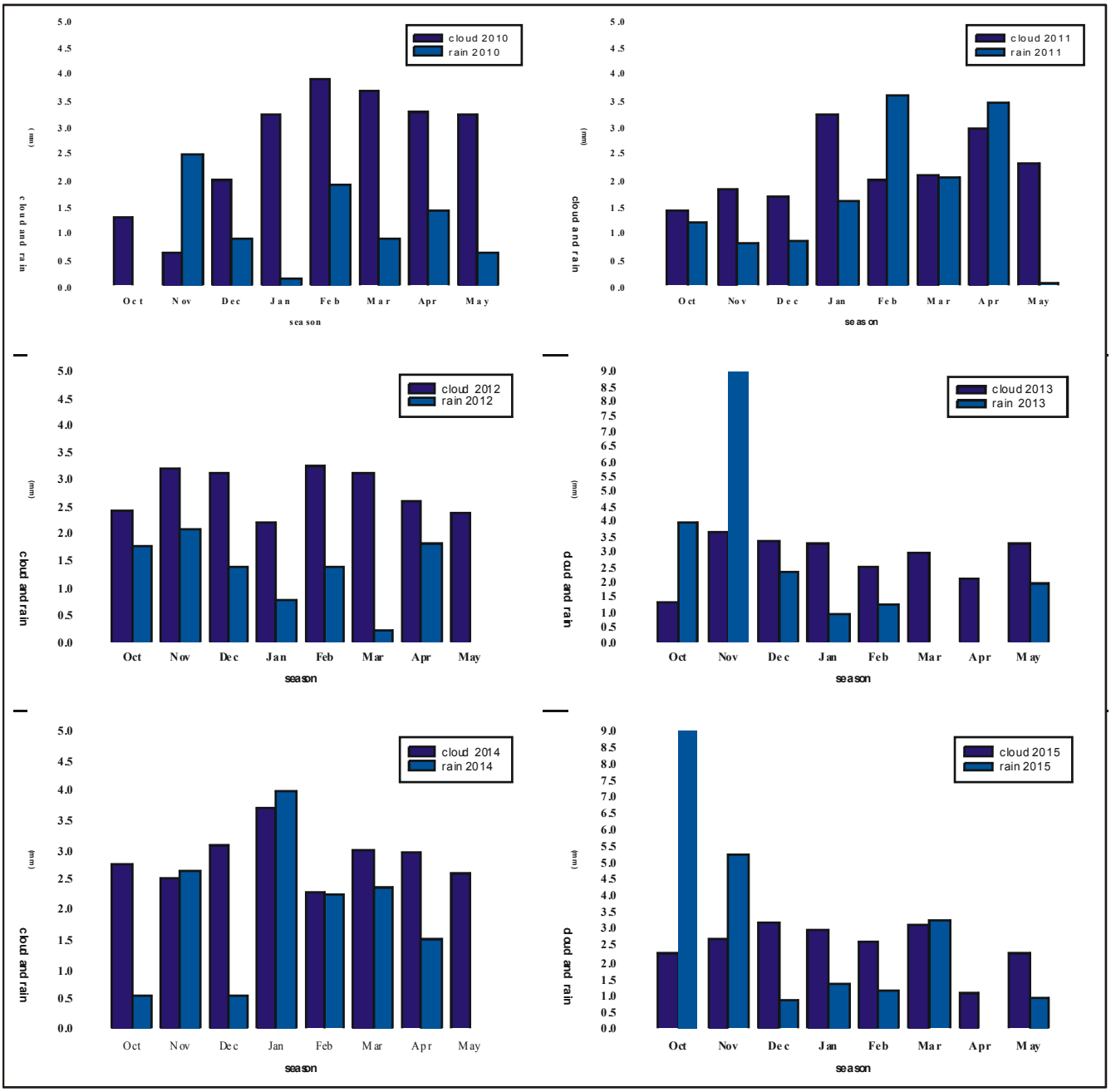

Fig. 2: Monthly mean of cloud and rainfall.

ratios were recorded in the year (2013). As for the lowest values recorded in the year (2013) for the month of October, where it was (0.004%) and also in April of the year (2015) and its value (0.005%) and in May, it found (0.002%) in the year (2012). As for the average percentages, their value ranged between (0.12%) to (0.35%), as it was observed that these ratios ranged between (17-31%) of the quantities of clouds carrying rain, as the highest in January was compared to most months of the study years. The difference or variation of these proportions is due to the nature and type of clouds producing rain in that region. If we had a good look at the highest percentage recorded, we would have found that it is natural that there is a percentage of clouds of the type of low produced for rain because this type of clouds contains quantities of water capable of giving such percentages taking into account the months in which clouds formed. As for the average proportions, they were from clouds with light showers, which ranged between (0.12 and 0.34%).

The ratios of clouds to rain levels do not have to be direct. That is to say, not that whenever the weather is cloudy there must be rain. But there is a product of rain such as low clouds and there are those that have few rates, which are almost non-existent, even if the weather is cloudy. As in the month of October of the year (2010) and the month of May of (2011 and 2012), respectively. Also in the year (2013) for the months of March and

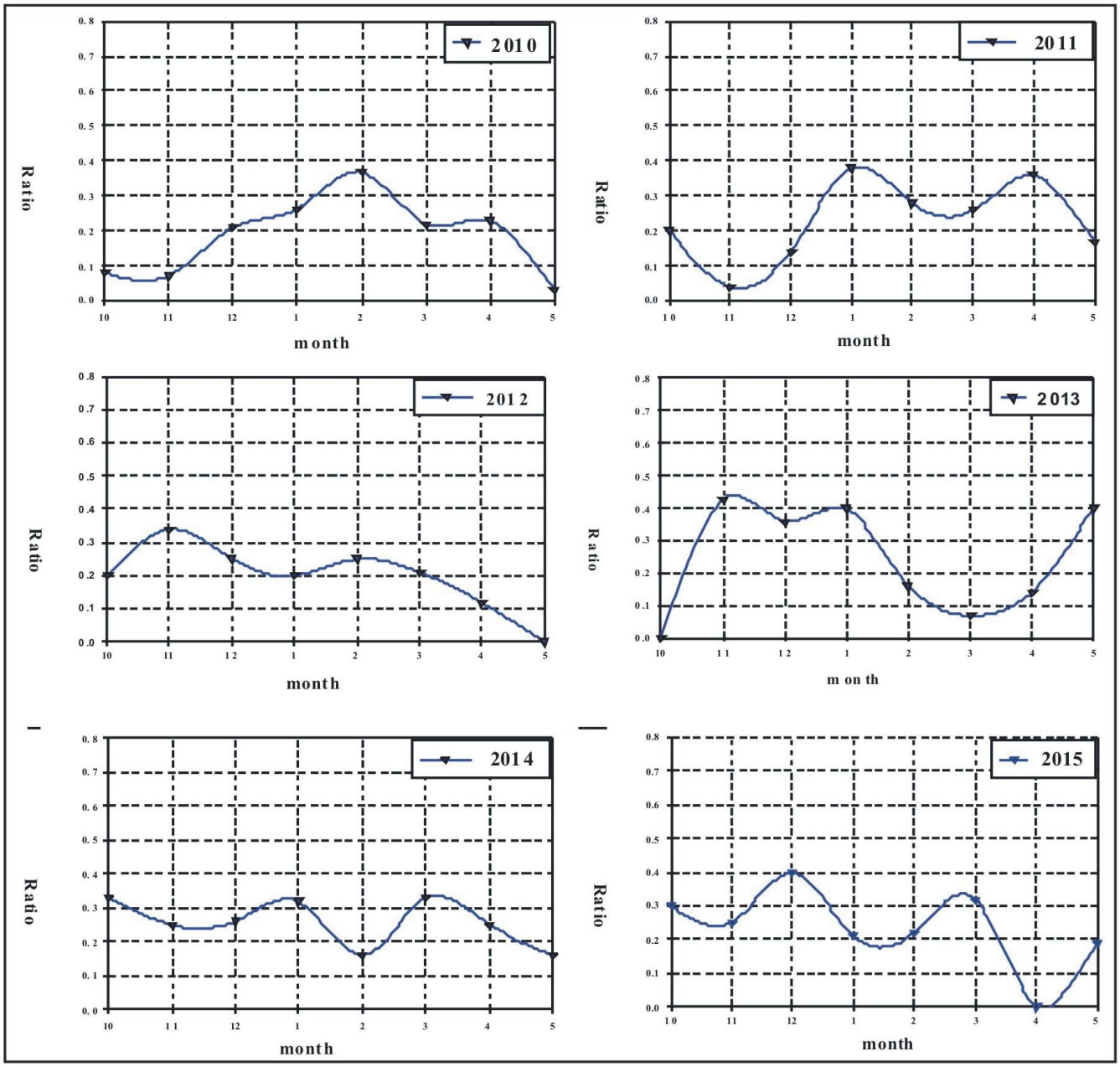

Fig. 3: Time series for rain full to clouds for the winter season a manual for the period 2010- 2015.

April and the month of May for the year (2014) and finally in the month of April of the year (2015). In addition to that there are varying proportions of the amount of clouds with rain. Where we notice through fig. 2 in the month of November of the year (2013) that the amount of rain was higher than the amount of clouds. This indicates that the clouds were of the low type producing the rain. There is a decrease in incidence, as in January of 2010. Also in the month of May of the year (2011), as the above figure showed us the results of the rain-to-cloud ratios, which are highly dependent on the clouds and if the weather is cloudy, it does not indicate the presence of rain.

As for the second axis of the study, the rain-to-rain ratios for the rainy season were studied and analyzed separately for each year for the same study period to determine the most proportionate months and the result was that February is one of the rainiest months, which was characterized by the amount of rain clouds in which the highest a percentage of between the rainy season by three years from the study period, i.e. (50%). Which is cooler than the precedent and that this means in the case of clouds in the sky that the probability of it falling is relatively large, compared with the rest of the months the possibility of the clouds producing rain in it is greater and there are cases where there is almost a percentage (33.3%) of the clouds producing rain as in March and April, It was noted that the month of October at the same rate (33.3%), unlike the month of November and December, which was weak due to the lack of production of clouds in them for rain and it became clear in January that a varying percentage ranged between (25-33%) of the total season As for the month of May, this month the possibility of clouds and its production of rain is very guest due to the high temperatures in that month.

Conclusion

1. It was found that the highest monthly percentages are in November 2013, when it reached (0.42) and the lowest percentage was zero in October 2013.

2. The ratio between the amount of rain and the monthly clouds is in the form of an oscillating wave between the highest value of (0.42) and the lowest value of zero.

3. The results showed that the period between the upper and lower value is two years except for the month of February where the results were that it is in a continuous state of decline that will continue from the year 2010 to 2014 with a slight rise during the last year.

4. The study also concluded that the month of February is one of the rainiest months, which was distinguished by the fact that the amount of rain clouds is the highest annual percentage among the rainy season (0.5) by three years, so it is cooler than the precedent and that this means in the case of clouds in the sky That the probability of it falls is relatively large, compared with the rest of the months, with the possibility that the clouds producing rain in it will be greater.

5. The results indicated that the year 2013 is one of the rainiest seasons compared to the rest of the years, when its value reached (182.255) mm

6. The results also showed us that the ratios of rain to clouds depend heavily on clouds, which if the weather is cloudy, it does not indicate the presence of rain.

Reference

Cattani, E., F. Torricella, S. Laviola and V. Levizzani (2009). On the statistical relationship between cloud optical and microphysical characteristics and rainfall intensity for convective storms over the Mediterranean. *Natural Hazards and Earth System Sciences*, **9(6):** 2135.

Gungle, B. and E.P. Krider (2006). Cloud to ground lightning and surface rainfall in warm season Florida thunderstorms. *J. of Geophysical Research: Atmospheres*, **111(D19):** 1-15.

Groisman, P.Y., R.S. Bradley and B. Sun (2000). The relationship of cloud cover to near-surface temperature and humidity: Comparison of GCM simulations with empirical data. *Journal of Climate*, **13(11):** 1858-1878.

Kokhanovsky, A. (2004). Optical properties of terrestrial clouds. *Earth-Science Reviews*, **64(3-4):** 189-241.

Mishra, J.K. and O.P. Sharma (2001). Cloud top temperature based precipitation intensity estimation using INSAT-1D data. *International J. of Remote Sensing*, **22(6):** 969-985.

Roth, D. (2006). Unified surface analysis manual. *PDF. Hydrometeorological Prediction Center. Retrieved*, 10-22.

Singh, V.P. and D.K. Frevert (Eds.) (2002). *Mathematical models of small watershed hydrology and applications*. Water Resources Publication.

Szyniszewska, A.M. and P.R. Waylen (2012). Determining the daily rainfall characteristics from the monthly rainfall totals in central and northeastern Thailand. *Applied Geography*, **35(1-2):** 377-393.

Thoss, A., A. Dybbroe and R. Bennartz (2001, October). The Nowcasting SAF precipitating clouds product. In *Proceedings of the 2001 EUMETSAT Meteorological Satellite Data Users' Conference, EUMETSAT* (399-406).

Zhang, D., C. Xu, J. Duan, Y. Wang, J. Du, S. Zha and R. Zhang (2015). Inter-annual variations of cloud and precipitation and their possible relationships with surface aerosols in Shanghai. *Aerosol & Air Quality Research*, **15(4):** 1367-1379.

Zhang, Y., S.A. Klein, J. Boyle and G.G. Mace (2010). Evaluation of tropical cloud and precipitation statistics of Community Atmosphere Model version 3 using CloudSat and CALIPSO data. *Journal of Geophysical Research: Atmospheres*, **115(D12):** 1-18.